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February 1989

THE MAC FLYER - For Greater Safety in MAC Air Operations

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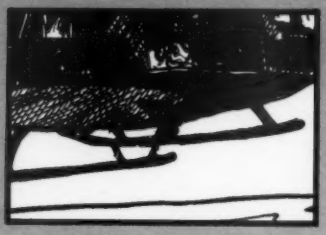

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COVER PHOTO By Frederick A. Johnsen

They almost didn't enjoy . . .

Sun and Fun in Florida

By Maj. Gary L. Jackson
Det 3, 625 MASG
Hellenikon AB, Greece

"There I was . . ." How many times, sitting at the bar, have you heard this introduction to a long and often boring story? Well, this isn't a boring story—at least it wasn't to me or the other instructor in the aircraft.

Neither of us had been T-33 instructors very long, but we both had previous ATC experience to the tune of 800-900 hours IP time. Our problems really started earlier in the week as we flew target missions in Canada. We flew only one sortie per night, normally on Wednesday and Thursday, but they were 0100 takeoff times. After the mission was completed Thursday night we were allowed to quick turn and fly cross-country anywhere in the CONUS as long as we had the aircraft back home by Sunday afternoon.

On this particular mission, my partner and I decided to fly to K.I. Sawyer for fuel and customs, then to Wright-Patterson for a visit to the Air Force Museum. This part of the plan went off without a hitch, and we were on initial at Wright Patterson at 0600 as the field opened. We ate a typical base operations type breakfast and then managed to catch a catnap in the crew lounge while we waited for the museum to open.

We borrowed a car at base operations and made our way to the museum. After a quick tour, we returned to the field and prepared to continue our trek down south. You see, we were destined for "sun and fun" in Florida.

Since our duty day as instructors was 16 hours, we decided to drop in at Warner-Robins and do some pattern work. We arrived there early Friday afternoon and shot 11 or 12 landings. After quickly refueling both aircraft and pilots, we proceeded to our final destination, MacDill Air Force Base.

For a change of pace, we flew an uneventful low-level navigation route to MacDill. Once on the ground, with our aircraft bedded down, we proceeded to base operations to close our flight plan and check things out. We found, to our dismay, that the runways were to be resurfaced the next day and would be closed from 0600 until 1800. After some discussion, we decided we should depart before field closure, since we had several sorties staring us in the face on our

1988 MAC Flight Safety Writing Contest Honorable Mention

way to Colorado Springs, and weather was forecast to be less than sterling.

A typical TDY evening at the O'Club was had by all—dancing, swapping stories with TAC pukes, and a little drinking. We felt indestructible, and didn't see the need to get more than a few hours sleep—and we didn't. Although we did stop drinking 12 hours prior to takeoff, we didn't hit the sack until about 0200. The 0430 wake-up call seemed to come too early, but upon very close inspection of my watch, I found that indeed it was time to get up.

We checked out of the hotel and caught a cab to the base, arriving at base operations at about 0515. After searching high and low for the (supposedly) on-duty forecaster, we finally found him asleep on a couch in the back of his office. It was too early for anyone to be up and around, especially for two pilots who hadn't had sufficient crew rest.

As the forecaster briefed the weather, our brilliant plan began to crumble before our eyes. We found the weather bad all over the southeast. The only usable field within range was Tyndall AFB, and the only suitable alternate was MacDill. Added to this was the fact ARTCC radar was down in the Tyndall area, and a high altitude penetration and approach would be necessary.

To a couple of experienced instructors, these were only minor inconveniences, not insurmountable obstacles. We were airborne at 0556 and had an uneventful flight

up Florida's west coast. ATC had advised us to expect no shortcuts across the gulf, as was normal, due to the radar problem. As we approached Cross City VORTAC, ATC called and asked if we wanted to proceed direct to Panama City TACAN. In order to save as much fuel as possible, we accepted the clearance. We were cleared for the HI-ILS 1 RWY 13L approach to Tyndall upon reaching the VORTAC. We dialed in PFN and proceeded direct. It was my turn to fly the approach, so I prepared myself as the other instructor in the back seat set up the NAVAIDS.

We hit the station and started the penetration. I turned left onto the 21NM arc to intercept the ILS. The weatherman had been calling a 200 ft ceiling and 1 mile visibility, and it looked as if his measurements were right on. As I approached the localizer course, I instructed the backseater to dial in the appropriate frequency. As I rolled out on course, everything looked good. Approaching the FAF at 6 DME, we performed our checklist procedures and lowered the landing gear, but noticed the glideslope wasn't coming down. If you've ever flown T-Birds, you know the instrumentation isn't too good, so this didn't bother us. We both agreed we should go down to localizer minimums, as we'd done on numerous occasions, and the glideslope would probably start to work momentarily.

I called departing the FAF and started descent. I leveled off prior to the visual descent point, still with no glideslope. Approaching the MAP we started to get a little concerned. We could see the ground and, although Tyndall was our home away from home, nothing looked familiar. Since MacDill was our alternate, this was to be our one and only approach, then we'd have to climb high and fly slow to make it back. It never occurred to us the field would be closed by the time we got there. Of course, we never really considered the possibility of not being able to land at Tyndall.

With all this in the dark recessess of my mind, and rapidly approaching the MAP, I quickly retraced everything we had done on the approach to try and figure out what had gone wrong. Then it hit me like a ton of bricks. What TACAN station was really dialed in? Could we have been so stupid as to have dialed in the wrong station? I quickly asked the other instructor to check and, judging by his "Oh, '%$$#'&" reply, I knew we'd screwed up.

He retuned the TACAN to PAM and we found ourselves still 6 DME from Tyndall, on course with an active glideslope, but well below it. I called the tower, told them we had made a mistake and were just now at the FAF, then started a slight climb back up to glideslope. After several panic-filled minutes, we landed safe and sound at Tyndall, checked in at Base Ops, and went our merry way as if nothing had happened.

At the snack bar we retraced our steps to determine what had gone wrong. Besides our lack of sleep the night before, in our haste to get on the ground, we'd made a major mistake—something very basic to instrument flying: **TIMS—Tune, Identify, Monitor and Select.** We had flown the entire penetration, arc, and approach using the wrong NAVAID, because we'd misunderstood the controller's instructions, and then hadn't reviewed the approach closely enough to realize we should have flown from PFN to the holding fix and then started the penetration. In this case, both NAVAIDS were aligned, so arcing off the wrong TACAN still put us on final; and with the radar out no one was there to catch our mistake.

I guess the moral of this story might be to stay with the basics, because they're tried and true. Or, it might be, never assume the other guy, even though he's an instructor, is going to do the right thing every time. I learned a very valuable lesson from this experience, fortunately it didn't involve a bent airframe or loss of life.

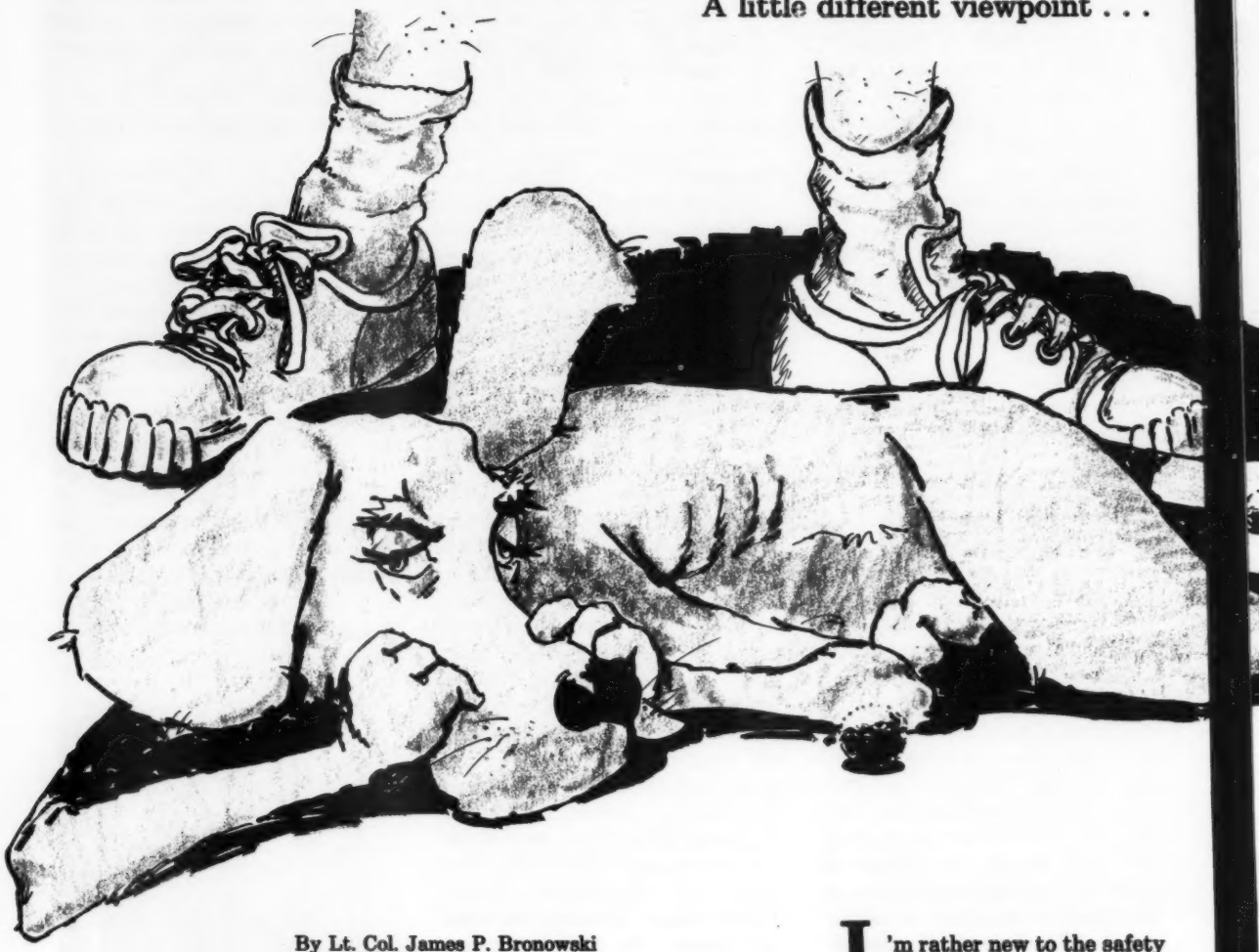
This story may have been exaggerated a little bit over the years, but the scenario is not all that different from the missions MAC crewmembers fly every day. Only the names and places are different. Whatever your crew position, learn from others' mistakes. Pay attention to details, and always crosscheck every move you or your crew makes.

Aircraft commanders are entrusted with a lot of responsibility and we owe it to the passengers (taxpayers), our supervisors, fellow crewmembers, and ourselves, to bring the aircraft home in the same condition as when it left.

A native of Dallas, Texas, Major Jackson has been a T-37 instructor pilot and a T-33 and C-5 aircraft commander. He is presently serving as Deputy Commander for Operations, Det 3, 625 MASG.

Safety! A Definition

A little different viewpoint . . .



By Lt. Col. James P. Bronowski
Chief of Safety
452d Air Refueling Wing (AFRES)
March AFB, California

I'm rather new to the safety business by way of occupation, but not by association. I've always practiced safety in my flying, driving, and leisure activities, but my personal safety techniques may not work on such a large scale with so many people. So I had to go to the dictionary to get started and find the definition of safety.

That part was easy, but puzzling. It said SAFETY was a noun, "Football, a play in which a player on the offensive team is

tackled in his own end zone and downs the ball there, or in which the ball goes out of bounds on a fumble, having last been in bounds or over the end zone and having last been in the possession of an offensive player."

You know, maybe I need to get another dictionary in my office to go with the one I received free from *Sports Illustrated*.

So I knew if I wanted to get off on the right foot and get myself a good working definition of safety it would mean another trip to the miniature golf course in Corona where my Norwegian pal, Nars Forgood, is the club pro.

Nars was not sitting in his normal place on the bench next to the club house. His old dog, Putter, wasn't enjoying the late afternoon sunshine in his normal spot under the bench either. Boy, that dog was about as smart as its namesake. Thinking Nars was probably in the back room checking out the bottle he always kept there, I sat down on the bench, leaned back, and closed my eyes. The good clean smell of the indoor-outdoor carpet on hole Number 1 almost made me forget the reason for my visit as I started to drift off.

As I started to nap, my head snapped back and banged against the aluminum side of the clubhouse. Now instantly awake and rubbing a developing bump on my head, I could see, through the white spots swirling in my eyes, old Putter trying to chase down another snail. As usual, he wasn't having much luck.

Nars came around the corner and tottered a bit as he came to a stop. My downwind position revealed ample evidence of 80 proof. He was dressed in an old gray sweater, baggy green pants, new white tennis shoes, and was topped with an absurd black baseball hat that said: "Cycle Bums Need Loving Too."

"Saints preserve us Jimmy, what happened?" he asked in an Irish accent.

"I just nodded off and seem to have whiplashed my head on the clubhouse here," I said, as I felt the knot on my noggin continue to grow.

"That's a bit of a relief, old man," he stated, sounding quite British. "When I heard the bang on the building I was afraid one of my students had developed a nasty slice."

"What can I do for you, Sport?" he asked as he sat down beside me and patted Putter on the head.

I detailed my dilemma and explained my need for a good definition of safety so I could better do my job and ensure the physical welfare of all members of the unit. I was sure with his safety background he would have the answer I sought.

"That's a tough one, laddie," he said as he leaned back on the bench and stared straight ahead, as was his norm when in profound thought.

After a while, as we both enjoyed the late afternoon sun, he began to smile, turned to me and said, "The answer is in the wee doggie 'neath our bench."

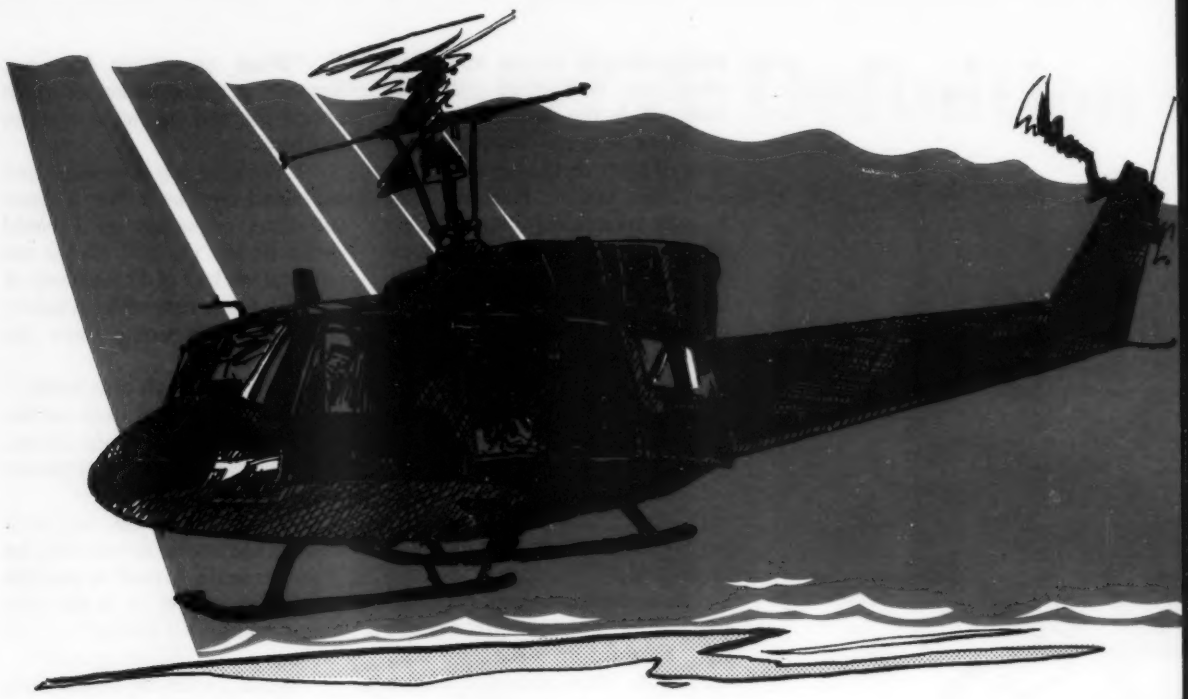
"I don't want to offend you, Nars," I said, "but that dog is so dumb he chases trees."

"Pardon, monsieur does not understand. Accidents are very rare in ze animal world, no? Ze reason for this is most, how you say—simple. You see, ze animals have ze innate sense of safety because they always suspect ze danger and harm all ze time."

I pondered everything he said with that horrible French accent and then it hit me. That's what safety is, it's looking at everything with a slightly negative attitude. Define how that thing or that activity could hurt me; and then, not let it. Look for the danger in all things and then avoid it.

"Thanks, Nars, for showing me that safety is a negative attitude."

"Ya, sure, you bet," he said as I looked at my watch and noted another three hours of annual leave were shot. I've got to learn to use the phone. ✈



Too Close to Call . . . even for the pro's.

By Maj. Stephens F. McCauley
Associate Editor

"It was like a competition. Each crew tried to haul more cargo than the last. Helicopters successively rotated into the coastal FOL to sling-load bags of cement, or stack sheets of corrugated aluminum through the large openings where the cabin doors had been. The monotonous, methodical rhythm of the operation incited each crew to call for more cargo to be added to their loads—to a point where hover in ground effect was just barely possible at max power.

"We watched 'Cowboy' Fernandez coax his Huey to slide, then bounce along with increased determination over the dunes and towards the water. As the fuselage disappeared from view over the last mound of sand, we all grimaced as ocean spray from the rotorwash boiled into the air. What a relief to see the chopper finally struggle through translational lift to gain a few extra feet of clearance above the ocean waves."

"Well, Hank, you've really set the tone for a good 'Stan Muldooner' here. Let me buy you one of those coconut drinks whilst I address our readership, and then we'll get back to the task of putting your personal flying story into printable form."

(Yo!—readers! Stan Muldoon on your channel again; writing to you from a quaint seaside village called Puerto Limon. Having a little reunion with an old buddy of mine who wanted to revisit the "scene of the incident." He'd been here on a civic action project some years ago, and finally got up enough nerve to resurrect a nightmarish flying episode—kept secret for well over a decade now.)

"Hey Stan, these coconut things are good. But, let me tell you from past experience, they can also make you 'go,' if you know what I mean! Speaking of making things go, did anyone ever explain to you what really makes a helicopter fly?"

"Okay, I'll bite."

"Well, you understand how a fixed wing airplane streaks down a runway—gathering aerodynamic

lifting energy until differential pressure just naturally sucks it into the air. A helicopter, on the other hand, gets its rotor blades to turnin', vibratin' and shudderin' with such a commotion until, finally, the earth just *rejects* it—upwards into semi-controlled flight!"

"I'm gonna quote you on that analysis, Hank. Now, about what happened here that got you into such unspeakable trouble so many years ago."

"I was a young copilot, on a sortie with the group's Chief of Stan Eval. Maj. Friendly was an excellent instructor; knowledgeable, patient, cool under pressure. He made an effort to share wisdom he'd acquired during his career flying an impressive variety of air machines—from F-100s to SR-71s. The principal factor in his credibility was his recent experience with Huey gunships in Vietnam.

"Friendly made it clear he disapproved of the daring competitiveness of Cowboy and the other pilots. So, after witnessing Cowboy's departure, he signaled the load crews (local village people) to bring the aluminum roofing sheets and then motioned them to stop loading when the cabin was only half full. He gently raised the collective for a hovering power check and made the standard radio call to our CCT (two sand dunes away on the same beach) as we departed the FOL for our destination.

"En route, some mild excitement occurred as our sheets of aluminum demonstrated their propensity for aerodynamic lift. When forward speed wedged some airflow between a few of the top sheets, they flew back against the transmission bulkhead. We slowed immediately and the gunner/mechanic sitting in the aft alcove was able to push the aluminum back into place, finally securing it by sitting on the forward edge of the stack and using his gunner's harness as a modified tiedown strap.

"We followed the coastline for about 20 minutes. Though not the most direct route, this flight path avoided climb over a mountain chain located only 10 miles inland. Entering the mouth of a river, my esteemed IP demonstrated nap-of-the-earth flying techniques he'd developed in Southeast Asia. I'd never seen such precise control and execution in low level maneuvering—this man was an artist!

"We easily located the project site, and Major Friendly let me make the approach and landing into the tight jungle clearing. The two other unit choppers were still unloading, so we parked and shut down in the small space remaining. The other pilots asked about weather on our flight, and we confirmed the low ceiling of broken clouds we'd just managed to sneak in under. The clouds were even beginning to spill over the mountains and down towards the ocean. Dim twilight was rapidly turning to darkness, and all agreed to return to our FOL in formation flight, with Major Friendly as leader. We expedited departure, retracing our previous track down the river valley with the other aircraft in tactical trail.

"As we reached the river's mouth, and the obstacle-free safety of the ocean, it was well past sunset. It seemed like the inside of a coal mine—with the lanterns turned out—no moon, stars, or ground lights. We tightened up the formation into echelon (for added integrity and security), and carefully flew a track along the coastline—just over the gentle surf caused by the ocean swells. Our left door gunner/mechanic lay on his stomach, leaning over the edge of the cabin floor, trying to keep the faintly luminescent ribbon of white beach sand in sight.

"Suddenly, the unexpected: We must've momentarily popped into cloud, because our trail aircraft declared 'lost wingman' and broke formation towards the open sea. It was Cowboy. He must've really had his hands full just fighting off spatial disorientation as he headed towards more inky blackness—with no destination within fuel-remaining range other than Puerto Limon. (The unattended NDB there was transmitting an intermittent station identifier, and we had confirmed earlier that its signal was completely unreliable.)

"All we could do was press on with our two-ship, still straining to keep some visual contact with the shoreline. At least Major Friendly was able to establish UHF radio contact with our CCT station at the FOL. Though we couldn't get a strong enough DF bearing signal, it was sure nice to talk with someone on terra firma. Just as he told them we estimated only 15 minutes out, our gunner/mechanic lost sight of the shoreline. More surprise clouds (concealed by the darkness) had put us into an IMC situation. Seems we had inadvertently entered a gradually descending layer of low cloud.

"Major Friendly took the controls and immediately dropped our formation to less than 100 ft on his altimeter. We all felt incredible apprehension, bordering on stark terror, as he angled our delicate rotorcraft towards a shoreline which we could not see. Though maintaining airspeed at a 'compromise' value of 50 knots, we knew that if we overflew the beach without detecting it, the mountain range would make for a messy point of impact.

"After an eternity (lasting about 25 seconds) of pursuing

such a course, better judgment and loss of nerve combined to inspire a new plan. Unable to reestablish visual reference with the beach, we reversed course to head back out over the 'safer ground' of the ocean at a more comfortable 200 ft altitude, advising Cowboy to stack up at a higher altitude for some vertical separation insurance. Major Friendly resorted to DR navigation on what we presumed was a course about 100 meters off the beach and parrallel to the shoreline. Flying at 70 knots, I concentrated to maintain 200 ft on my altimeter.

"Now, with better opportunity for line of sight reception, we again called CCT for a 'short count.' On the back side of the count, with the word 'four,' our remaining wingman miraculously got a bearing lock on. It was as if God had suddenly changed his mind and decided to give us another chance, in spite of all the foolish impudence which had gotten us into this pickle. But, at our slow airspeed, fuel was becoming another factor to add to our list of worries.

"CCT continued with nonstop long counts, and our wingman provided approximate heading info. We again descended to 100 ft (MSL, we hoped) and proceeded towards the CCT position at the FOL. The wingman reported large bearing pointer swings just as we detected a soft glow of lights through the soup which enveloped us. The CCT boys heard our rotors, popped a few flares in the landing area, and our formation touched down safely at last."

"Whew! What an incredible story, Hank! It certainly refutes any argument claiming that 'miracles just don't happen anymore.' But, what happened to the Cowboy?"

"Oh, yeah. When we told him to climb to higher altitude for vertical separation, he managed to break through the top of the muck at about 1,500 feet. He could see the moon, the stars, everything—including a solid undercast beneath, which went all the way to the base of the mountain range. Wandering aimlessly, he got lucky and spotted a 'hole' in the cloud deck. It had some lights shining up through it, so he made an approach to those lights and found himself landing in the clear area near the inoperative NDB at Puerto Limon."

"Sounds like you were all *more lucky than good.* Any lasting lessons?"

"Well, after shutting down and getting out of our aircraft, we found that all of us had a curious physical impediment in common—our knees were shaking so badly, none of us could walk with any semblance of dignity. Watching one another, emotions burst into tension-releasing fits of laughter. Some of us even fell down to the ground—discreetly kissing the sandy earth and giving thanks for our deliverance.

"Then Major Friendly spoke: 'Tonight's sortie was, without a doubt, the stupidest stunt I've ever participated in or witnessed in my entire career.' (Acknowledgement of his own entrapment by the always-contagious pressing-the-mission syndrome.) Then, with a tone of greater reverence, he added, 'We're simply fortunate to still be alive . . . no question about it.'

"Feeling like a band of resurrected angels, our little group dispersed and quietly returned to town and our dormitory rooms above the Chinese restaurant. The experience was indelibly imprinted in our memories, but we never discussed it even privately; much less with others. There was, however, a definite catharsis in our approach to operational missions. Even Cowboy settled down."

"Sounds like you all shared a very strong bond after that—like veterans bound by a common dramatic experience. Glad that you finally felt the urge to share it. I hope our readers will discuss their own impressions and analysis of what actions you *should* have taken on that mission and, hopefully, learn some lessons in the process."

Well, readers, thanks for your undivided once again. Hope this one produced at least a kernel of inspiration for each of you. I know it did for me! Until we meet again, this has been Stan Muldoon, *wishing you safe skies and mission success!*

Preventing Ice and Water Ingestion Flameouts in High and Low Bypass Turbine Engines

Although very rare, jet engine flameouts in the presence of heavy precipitation are a continuing phenomena.

In the recent past, two Boeing 737-300s flying in or near thunderstorms in heavy precipitation had twin-engine flameouts; in one instance restart attempts were unsuccessful and the plane landed dead-stick on a river levy near New Orleans. In a third case involving a 737-300, one engine flamed out under similar circumstances. Several years ago, a TWA L1011 had two engines rollback to sub-idle in heavy precipitation, but the crew was able to restart them and the flight landed uneventfully at JFK. In 1977, a Southern Airways DC-9 in the vicinity of heavy thunderstorms near New Hope, Georgia, flew into hail and rain, flaming out both engines. During the subsequent deadstick landing on a country road, the airplane was destroyed and 62 passengers and crew were fatally injured.

This article, excerpted from recent material from Pratt and Whitney, explains the effects of ice and water ingestion on turbine engines, and offers techniques to minimize the chance of engine flameouts if you can't avoid heavy rain and hail.

The complicated and varied interactions that determine water ingestion effects on turbine engine operation preclude detailed quantitative engine module-by-module analysis. However, the overall qualitative changes in engine operation resulting from water ingestion through the engine are listed below for a constant throttle position:

N1 & N2	May or may not be affected—depends on engine control mode and amount of water ingested.
EGT	Decreases.
Fuel Flow	Increases.
Surge	Increased possibility.
Flameout	Increased possibility.

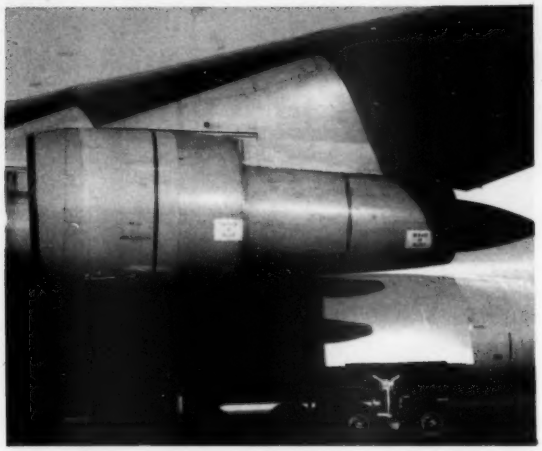
Water ingestion, in liquid or solid form, affects engine operation because of water's higher specific heat and the latent heat of vaporization associated with evaporation. To put it simply, it cools the engine's internal parts. When flying through heavy rainstorms, the compressors of a dual compressor engine are "rematched" by the water ingested. This is caused by water vaporization in the engine which absorbs about 1000 BTUs per pound of water from air passing through the engine. The effect is an air temperature reduction in downstream stages of the compressor and in the combustion chamber. Ice ingestion further increases compressor cooling as it gives up heat to melt the ice, and then gives up more heat to evaporate the water. The degree of rematch is proportional to the water/air ratio and compressor design. The compressor rematch moves the high pressure compressor operating line toward the surgeline (Fig 1) causing the compressor to be more susceptible to surge.

In addition, water may affect compressor and engine response as aerodynamics, tip clearance, and sensed control parameters become modified. If sufficient water is ingested, compressor surge or engine flameout may occur.

Engine inlet size basically determines the capture area for water ingestion, and the amount of air ingested depends upon aircraft and engine speed. At high aircraft speeds and low engine RPM (i.e. descent) more air is being forced into the inlet than the engine requires. Thus air is spilled out of the inlet, effectively reducing the size of the column of air being ingested. Water droplets are heavy and aren't ejected; their ingestion results in an increased water/air ratio. On a typical high-bypass ratio engine, this "scoop factor" during idle descent increases the water/air ratio by as much as *200 percent.*

Increasing engine RPM increases the airflow requirement while maintaining the same area for water ingestion. Reducing aircraft speed will also reduce air spillage around the inlet. This combination significantly reduces the water-air ratio (Fig 2). (Therefore, try to maintain higher RPM and reduced velocity when penetrating heavy rain. *TMF.*)

The effect of water ingestion on engine response varies depending on the type of fuel control installed. Earlier model engines such as the JT8D and JT9D use a droop governing mode, whereas more recent engines such as the PW2000 and PW4000 feature an isochronous governing control. Engine response characteristics pertinent to each fuel control are



discussed separately below. (Engines on most MAC airplanes use droop governing controls. *TMF*)

Figure 3 illustrates water ingestion effects on fuel control schedules for engines using droop governing controls. Dashed lines represent fuel required (operating) lines for various rates of water ingestion. As the water/air ratio increases, the operating line moves upwards toward the acceleration schedule. The higher the operating line, the more fuel is required to run steady-state. It's apparent from the line slope of constant throttle position on the diagram that a rise in the operating line results in a loss in N_2 speed when throttle position remains fixed. The acceleration schedule represents maximum fuel/air ratio available to the engine. As the operating line rises, it can, under the most severe situation, reach the accel schedule, at which point the fuel control would be unable to deliver additional fuel to accommodate increasing water ingestion. Under this condition, the engine would spool down to the point where maximum fuel flow available was only sufficient to operate the engine steady state. This would eventually result in spool down below idle, loss of throttle response, and electrical power loss if the generator drops off the line. As the airplane leaves the heavy precipitation area, the water/air ratio decreases and the fuel required line lowers, allowing the engine to reaccelerate to the original set speed. This of course assumes water ingestion surge or flameout hasn't occurred.

Engines with isochronous governing respond similarly except rotor speeds will not change at constant throttle position as water ingestion increases until reaching limiting acceleration fuel schedule. At that point the engine rapidly spools down.

Engine response to throttle movement varies depending on the direction the throttle is moved:

Throttle Advance. As the fuel control operating line rises due to increasing water ingestion, the margin reduces between the operating line and the acceleration schedule. The engine will respond sluggishly to an acceleration command from the throttle because of the reduced "overfueling" capability of the control.

Throttle Retard. As the operating line rises, the margin between the operating line and the deceleration schedule is increased. In this case, engine response to throttle reduction is more rapid than normal, and can result in a sub-idle condition and possible engine flameout.

In summary, water ingestion by a turbine engine results in:

—Reduced surge margin.

—Possible engine spool down to sub-idle.

—Possible engine flameout.

—Sluggish response to throttle advance and rapid response to throttle retard.

Preventing water ingestion flameouts.

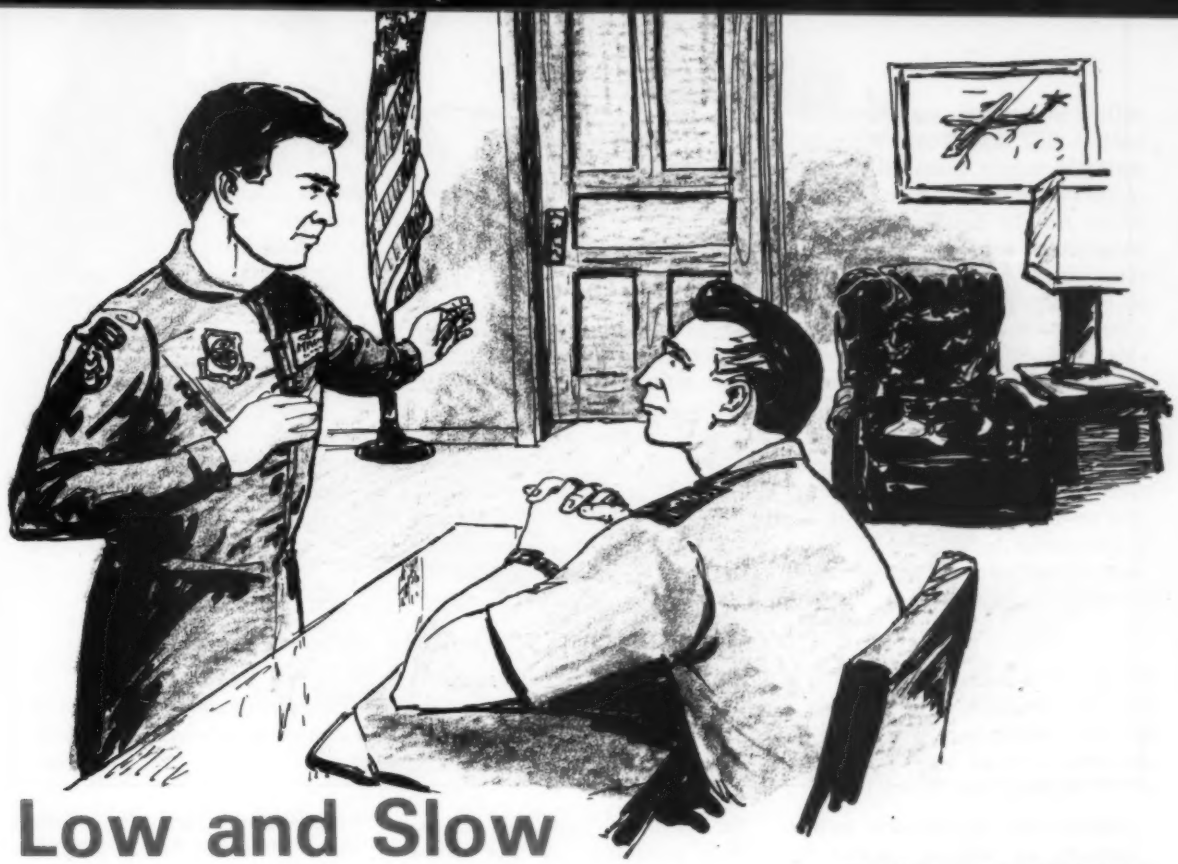
- Avoid severe storms. Typically, highest water concentration exists between 15,000 and 20,000 ft MSL. If you must fly in extreme precipitation, use these recommended techniques:
- Turn on the ignition system to protect against engine flameout.
- Turn auto throttles off to avoid rapid throttle movements and protect against engine spool down.
- Reduce aircraft speed and increase engine RPM to reduce water/air ratio, increase engine energy to deal with water evaporation, and protect against spool down. This condition is most prevalent when at low thrust during descent and holding operations.
- Avoid rapid throttle movements to reduce possibility of engine surge. If you must make thrust changes, move throttles very slowly and do not change throttle direction until the engine has stabilized.

These procedures are most effective if accomplished before entering extreme precipitation. Check your flight manual for procedures specific to your aircraft.

An Aerospace Industries Association (AIA) committee consisting of representatives from engine and aircraft manufacturers are studying the effects of water ingestion on turbine engine operation. This article contains information available at time of print.

This article was produced in coordination with Boeing Aircraft Company, Douglas Aircraft Company, and Airbus Industrie. ✈

Adapted from: *Flight Ops*



Low and Slow

A lesson in aerodynamics.

"Okay, MacKenzie, what have you come up with?"

"Well, as you're aware sir," Mac MacKenzie began as he addressed his boss, Maj. Gen. H. A. Knailes, Numbered Air Force Commander, "this project was generated by an unusual simulator incident at one of our C-130 wings. A crew receiving an annual evaluation experienced an uncontrollable flight condition, after letting airspeed inadvertently decrease during a simulated 3-engine approach and subsequent go-around."

"So, they let the airspeed get away, stalled, and crashed the box."

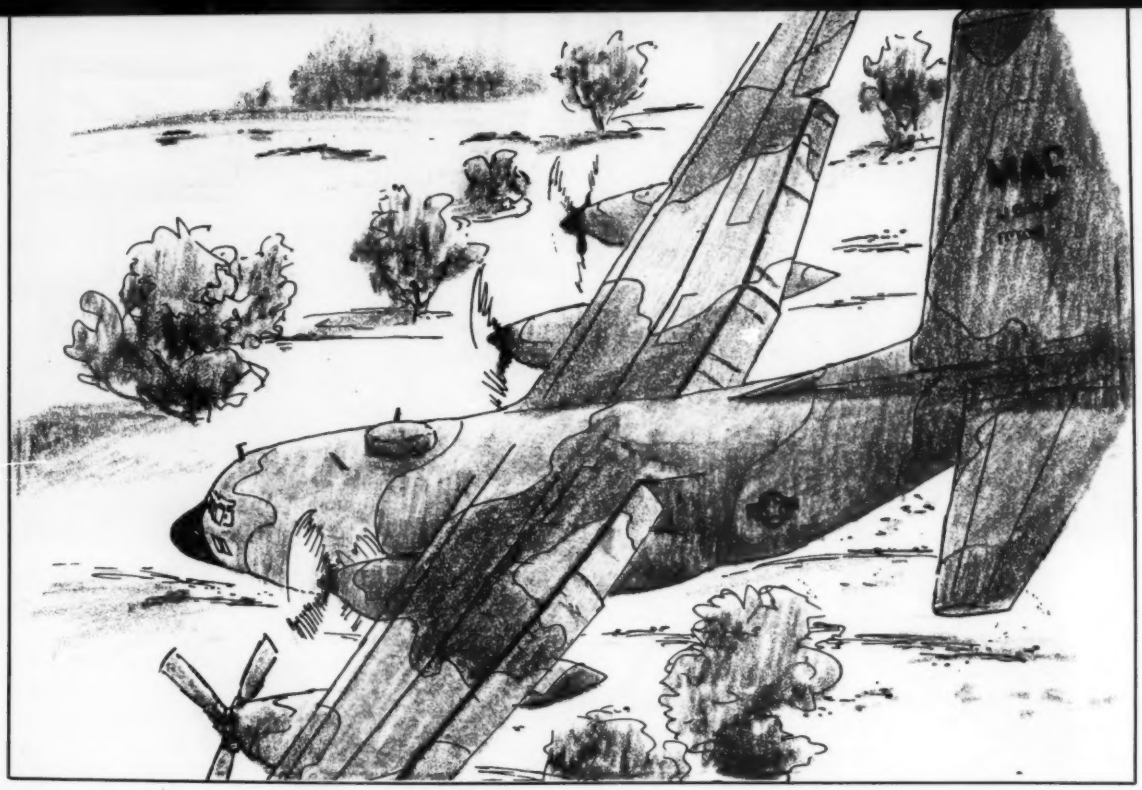
"On first look, that would seem evident, but it goes a little deeper than that, sir."

"Well then, get to the point."

"Yes sir. While at the wing, some of their computer whizzes and I came up with some computer simulations that led us to figure out what happened, using parameters from the incident mission. They were at an aircraft speed of 120 knots, gear down, flaps 100 percent, and altitude of 500 ft above ground level. Impact parameters were estimated as airspeed 80-85 knots, 45 degrees left bank, full right rudder, full right aileron, and 5 degrees nose down elevator.

"We began the simulations with Number 1 throttle at flight idle, and the other three set at 30 percent of the power needed to maintain level flight. As in the original incident, the airspeed slows from approach speed of 127 knots to V_{MCA}. About this time, the nonflying pilot called "go-around," and the other pilot responded by rapidly pushing in maximum power on Numbers 2, 3, and 4. The airplane began yawing and banking left. At this point, power was applied to Number 1 engine and full right rudder applied to counteract yaw. The left bank continued to increase, so the pilot applied full right aileron to roll wings level. But with such low airspeed, the ailerons aren't very effective, and the airplane won't recover if you're too low.

"We ran several variations using different elevator inputs, and did a run with the pilot pulling all throttles to flight idle to



balance out asymmetric power instead of adding power to Number 1 engine. All these reactions are normal responses for average pilots. The results of these computer runs are fascinating! They indicate the aircraft will begin a rapid wingover, despite corrective actions, and *will* hit the ground before recovery from a low altitude. Projected impacts indicate a 26- to 35-degree left bank and an airspeed of 80 to 90 knots."

"All you've told me so far is *what* happened, but I need to know *why*, Captain."

"Ah, yes sir. Well, we had lengthy discussions about the reasons for the rapid wingover and inability to recover. Apparently, the rapid wingover is the result of an imbalance of lift caused by asymmetric power application. The wing sections directly behind the props are actually "blown" wing sections, which produce more lift due to the increased relative wind generated by the power-producing props.

"With Number 1 engine at flight idle and the other engines at maximum power, you're creating an imbalance not only in yaw, but also in lift. At 100 knots, there's a 4,000 pound imbalance. The rolling moment requires 22 degrees aileron and full right rudder to overcome.

"Additionally, this assumes instantaneous pilot response. If you assume a two-second reaction time delay, less than five degrees bank into the good engines, or a five-knot speed decrease, you'll end up with an uncontrollable lift imbalance. Such an imbalance causes the airplane to rapidly roll toward the failed engine. Once the airplane begins rolling, the ailerons may not have enough authority to reverse, or stop, the rolling moment.

"There are a number of reasons for this. First, since the wings are rolling, they have momentum which the ailerons must overcome before they can begin to roll the wings back toward level flight. Again, reduced airspeed greatly decreases aileron control authority. More importantly, V_{MCA} increases dramatically in this situation.

"Tests to compute minimum control speed were conducted by flying a C-130 with full aileron and full rudder input with three engines at maximum power, then gradually slowing the aircraft until directional control was no longer possible. This type of stable platform contrasts sharply with the incident scenario, which is a dynamic/sudden situation with rapidly changing forces and inputs.

"Additionally, V_{MCA} increases significantly with less than the ideal conditions of full rudder deflection at high boost pressure and five degrees bank away from the inoperative engine. By merely having the wings level instead of in a five-degree bank, V_{MCA}

increases by 13 to 20 knots. Banking *into* the inoperative engine increases V_{MCA} even more, and in the scenario we had in the simulator, the "airplane" eventually approached at least 45 degrees of bank into the "inoperative" engine.

"Boiling all this verbiage down, sudden assymetrical application of maximum power at or near minimum control speed will probably cause a crew to lose control and probably crash if they're too low to recover. Is that what you're trying to say, MacKenzie?"

"Yes sir."

"Now, why don't our people know about this phenomenon? Sounds like basic aerodynamics to me."

"The C-130 Dash One discussion of air minimum control speed includes one paragraph with a general description of what conditions are used to determine it. It also states that V_{MCA} will be higher if you don't use five degrees bank or high rudder boost. The One Dash One repeats that information and also includes mention of a resulting yawing tendency from asymmetric thrust which must be balanced by rudder application. It also states decreasing airspeed reduces the effectiveness of aerodynamic controls."

"That does part of the job, but what information do they get during their basic C-130 qualification course?

"The pilot study guide lists only the conditions for V_{MCA}; bank angles less than five degrees into the good engines, high rudder boost, and ambient temperature are mentioned as variables which can raise V_{MCA}."

"What! There's gotta be more than that."

"There is *some*, sir. The lesson plan used by C-130 academic instructors is nearly identical to the study guide, except for two additional items. The definition for V_{MCA} in the lesson plan states that V_{MCA} allows for directional control *only*, and doesn't guarantee an ability to climb or even maintain level flight. It points out that failure to establish a five-degree bank away from the dead engine can raise V_{MCA} by as much as 20 knots."

"That still doesn't address the problem that started this whole thing. It's still not a complete enough analysis to prevent a mishap."

"No sir. The C-130 simulator instructor training syllabus does contain more discussion of V_{MCA} than any previously mentioned reference. It states that if you lose an engine at or above V_{MCA}, you can recover the aircraft with little or no aircraft heading change. This section continues for two pages and includes the variable effects of engine performance, bank angle, and hydraulic pressure effects. A chart depicts actual V_{MCA} increase for each variation. However, this syllabus is only issued to simulator instructors at the basic qual course, and isn't available to students or other pilots."

"Well, we have to get this information out to the crews! They've got to know about this problem and see how such a situation can develop. We're obviously not doing that now."

"That's correct, sir. Currently, flight below V_{MCA} is only demonstrated for instructor pilot upgrade candidates. This is done using the same stable platform method used to determine V_{MCA}, with no mention of the consequences of a sudden asymmetric power application at or near V_{MCA}. Additionally, no discussion is available concerning the significant lift imbalance this maneuver generates. Instructor pilots who flew our profile were surprised and, frankly, unprepared to react to the roll rate they experienced when suddenly applying asymmetric power with the flaps extended. Obviously, if this happens at low altitude, there might not be enough room to recover."

"Then your job is to get the word out, MacKenzie. To our crews, our instructors, and the training folks up and down the line. How do *you* propose to do it?"

"We've been working closely with MAC flight safety, stan-eval, and training since we starting seeing the results of our test runs. We're discussing briefings to formal school instructors and the field, additions to ground school, simulator, and flying course syllabuses, Dash One changes, and changes to some manufacturer publications."

"Exactly. Get on it. I want a full report—30 days."

"Yes sir. Thirty days."

MAC paused just outside the general's office and let out a deep breath before heading for his own office. The general's secretary gave him a knowing smile as he left; she'd seen the same reaction many times. The general's nickname, "Hard As," was apt and well earned, she thought as she went back to her typing. ★

Nettled in the Great Northwest - tall pines, and fresh air.

Wing headquarters - Large scale models of a winning team.

McCHORD AIR

What's Past is Prologue - The 62d is in the process of building an air museum that'll rival the best.

The 62d Militar

At Last—Shangri La!

By Capt. Dan Dougherty
Associate Editor

A location defined as remote, beautiful, yet imaginary; where life approaches perfection. *Well*—maybe a little exaggerated, but after visiting this special place during two of their few days of sunshine, if I ever get close to Shangri La, it'll remind me a lot of McChord.

This area is known as the Great Pacific Northwest, where the focus is on beauty, wilderness, and family atmosphere. "It's a great place to live," according to those stationed there. They have ocean, rugged mountains, desert, hunting, fishing, hiking, etcetera! After a day full of interviews, I wrote, "Everybody loves it here!"

So, what's this have to do with flight safety? At first I didn't know. In fact, I can honestly say I pondered this question long and hard before I could even postulate a theory that ties "a nice place to live" with the enviable safety record earned by this only Air Force wing that combines strategic and tactical airlift elements.

Of the two C-141 flying squadrons, the 4th Military Airlift Squadron has gone 21 years without a mishap; and the 8th Military Airlift Squadron, 8 years. But McChord's sole C-130 squadron, the 36th

C-130 Simulator building.

IR FORCE BASE

tary Airlift Wing

Tactical Airlift Squadron, wins the prize with 22 years mishap-free flight.

"Works great!" was how Col. Michael R. Gallagher, 62d's Deputy Commander for Operations, described the combination of C-141s and C-130s in the same wing. Colonel Gallagher went on to say the aircraft mix enhances McChord's mission capability. For example, Starlifters are used to complement the Hercules during exercise deployment. Last summer, McChord was able to tailor their support to the U. S. Forest Service while they fought destructive fires in Yellowstone National Park. Overall, the combined activity encourages an important mingling of attitudes among the crews, and the team effort emerging is one in which the best attributes from both are combined to make the 62d an impressive fighting force.

While this group of aircrews seems totally on top of the world and pleased with everything, they also have a very serious side that surfaces whenever they consider their flying and McChord's unique hazards. The two most prominent local challenges are weather and terrain.

Whenever most people speak of McChord, both insiders and outsiders, you'll hear "it rains all the time." Is that really true? I didn't know, so I studied an Air Weather Service Climatic Brief. The "averages" presented are compiled from observations taken from August 1940 to November 1983. The information is revealing.

For example, McChord's residents have a limited view of their world 167 days a year with visibility less than 7 miles. One hundred fifty-eight days have some amount of precipitation recorded, while five months, November through March, average out to a cloudy day, every day. During the worst month, January, their airfield is under Instrument Flight Rules 40 percent of the time. In fact, throughout the year, one of every four days is under IFR.

A popular T-shirt sold in the area sums up the weather with its banner: *Seattle Rain Festival, January 1 to December 31.* But the residents don't complain about weather. Crews refer to the base as "McFog," and readily boast about how proficient they stay in instrument procedures. When their valley socks in, Starlifter crews do more than "practice" Category II ILS approaches—they rely on them.

By itself, an instrument approach to minimums is challenging, but can become potentially life threatening when performed at the end of a long crew day that may have started in Japan. McChord crews have an axiom for those moments, and refer to it as "putting on the approach face." Weather isn't the only hazard. Wherever there's a landing field in a valley, mountains surround it.

Fourteen years ago, a McChord C-141 was radar vectored into one of the Olympic mountains during approach. Even the newest copilot I talked with spoke of the accident as if it had occurred last week. Everybody keeps the lesson learned from that tragedy alive. The spinoff advantage is that McChord crews carry their dedication to situational awareness beyond home station.

Both hazards, poor weather and mountainous terrain, exist throughout McChord's worldwide jurisdiction. McChord's location places it first and primarily to support such exotic and *COLD* places as Canada, and Alaska with her fabled and bitter wind-blown Aleutian Chain. Exceptional habit patterns are life savers. McChord crews carry those home station "approach faces" wherever they go, and in whatever they do.

The 62d continually devotes professional effort managing those "natural" hazards; in the same way, their professionalism is written all over their aggressive tactics program. First and foremost, the 62d views their mission as one of training for war.

McChord's wing commander, Col. (Brig. Gen. Select) Edwin E. Tenoso, devotes all available resources and time preparing for it.

McChord crews frequently conduct chemical warfare training that quite accurately simulates realism. Here's how they do it: at the end of a local proficiency sortie, the crew parks in a particular spot and shuts down. At this point, the basic crew suits up in full chemical gear. The instructor pilot and a safety NCO forego protective garb to become safety observers.

When ready, recovery maintenance people, also dressed in chem gear, service the aircraft. Then aerial port delivers, loads, and secures training cargo. They too are dressed for the occasion. When ready, the crew runs the appropriate checklists, starts and taxis to another parking spot where chem gear attired marshallers park them. Then, aerial porters offload the aircraft.

If you've ever worked in chem equipment, you know how difficult it is to function in. The 62d *actually* trains like they're going to fight. With each exercise, they take copious notes summarizing what went wrong, what went right, and how they could do it better. Some of the things they've learned to overcome would be definite showstoppers if they were performing an actual mission for the first time in this garb.

Chemical warfare is only one area McChord trains in; they also devote tremendous energy to their combat tactics program. This is one area where mixing Starlifters and Hercules aircraft and crews pays high-yield dividends. While there are marked differences in parameters and performance between the two airplanes, the ultimate mission is identical—get the goods to the war.

While the Hercs "do it in the dirt," and the Starlifters are on the receiving end of tankers "passing gas," they both move the boxes. Both aircraft deliver via parachute or airland, and they both have to know how to "tactically" and survivably ingress and egress. On these counts, strategic and tactical airlifters become very similar.

Although some may argue that technique differences stand out most, McChord crews would consider the argument moot. After all, surface-to-air missile avoidance in a cargo airplane is a shared goal among cargo crews. Our detection avoidance techniques are quite similar, even when compared to those of a fighter or helicopter. In this regard, there is information to be shared, and McChord's crews share it. Tactics, its need and application, is an agreed-upon subject. But agreements run deeper among 62d aircrews.

One of the questions I always ask on these assignments is what crews like most about their wing's organization or mission. With a refreshing unanimity, McChord crews like their maintenance. Repeatedly, I was told how they prefer flying their own planes while on the road.

There's more to this than unit pride. With recent fleet-wide problems, particularly C-141 spoiler malfunctions and C-130 4-engine power rollbacks, McChord has yet to experience either. As recently as 1987, the 62 FMS and the Associate 446 FMS won the Air Force Maintenance Effectiveness Award for Best Field Maintenance Squadron.

Additional, yet unsung, heroes that help a maintenance organization win awards and aircrew praise are the supply and fuels people. McChord's are no exception. In 1983, the 62d Supply Squadron took MAC's and USAF's Supply Effectiveness Award, and their fuels section won the American Petroleum Institute Award in 1986 and 1987.

The list of this organization's accomplishments goes on and on. Air Force and MAC awards, exceptional safety record, and sky-high morale; I return then to my original question, what does a "nice place to live" have to do with flight safety?

As you sift through a laundry list of McChord achievements, it would be too easy to drop this premise and conclude that location has no effect. Indeed, persuasive arguments could be presented on both sides as to whether location affects performance; but even when phrased like this, the "ayes" have it.

Location must certainly play a part; when I started looking for proof, it became obvious. In fact, the theme within the responses was unanimous. When you enjoy where you're living, you enjoy your job. You take that attitude to work with you, and it becomes infectious. In other words, when you're content with home life, you can concentrate at work.

And concentration was evident. Enthusiasm ran through all facets of the work being done. I would be remiss if I didn't at least recognize the fact there are those who don't "love" it there. But the pervasive attitude was so strong, everybody puts out the extra effort.

Don't get the wrong idea, location alone doesn't do it all. It takes leadership at all levels and a healthy amount of self-discipline. Both principles were clearly evident in their chem warfare training—leadership that implemented, self-discipline to make it worthwhile. These two go hand-in-hand throughout this wing's mission.

McChord is a *nice place to live*, and the 62d is a *great place to work!* Their mission is their driving force and everyone, top-down and bottom-up, works toward its accomplishment.

REFUSED TAKEOFFS

Weigh the alternatives, then accept the consequences of your decision.

By Capt. Dan Dougherty
Associates Editor

EXAMPLE 1:

DC-10 Rejected Takeoff Runway Excursion
Dallas-Fort Worth, Texas

Last May, a commercial airline DC-10-30, departing Dallas-Fort Worth IAP at near maximum takeoff weight, received substantial damage when the takeoff was aborted at V_1 in response to an erroneous slat warning. All but two brakes lost effectiveness and resulted in a runway excursion and nose gear collapse. Only two (recently installed) brakes operated properly; remaining brakes were about 80 percent worn.

According to the National Traffic Safety Board, almost simultaneous with V_1 (166 KIAS), the "Flap/Slat Disagree" light illuminated accompanied by activation of the aural warning system. The captain immediately rejected the takeoff with 3,465 ft of runway remaining. All reject procedures were promptly accomplished and acceleration forces quickly went from positive to negative. Nevertheless, airspeed peaked at 178 KIAS before falling rapidly.

The airplane slowed to about 130 KIAS in nearly 6 seconds, but by that time all but two of the main gear brakes had failed. With this loss, deceleration sharply decreased and the aircraft departed the pavement at about 97 KIAS.

The nose gear quickly settled into the soft dirt and eventually struck a frangible concrete approach light foundation which caused the nose gear and supporting structure to collapse. The aircraft halted about 1,000 ft off the pavement.

The first officer and flight engineer suffered spinal compression fractures; the captain and 5 of the 240 passengers suffered only minor injuries during the overrun and evacuation.

As a result of this accident, brake dynamometer tests will be conducted in coming months on all U. S. certificated jet transports to determine maximum permissible brake wear limits at maximum takeoff gross weight.

EXAMPLE 2:

Boeing 747 Rejected Takeoff Runway Excursion
New Delhi

Last July, a commercial airline 747-228 overran the runway and was substantially damaged. The first officer was flying at the time and initiated the abort about 2 seconds *after* V_1 following a Number 4 engine fire warning. The nose gear and all main gear collapsed during the overrun. There were no serious injuries.

The takeoff roll was normal; at V_1, the first officer removed his hand from the throttles and about 2 seconds later, Number 4 engine fire warning activated. The captain reached in the direction of the throttles, a move the first officer interpreted as a sign to abort, so he very rapidly took hold of the throttles and executed the reject.

Airspeed peaked at 170 KIAS, and autospoilers *did not* deploy, but were deployed manually at about 100 KIAS. The jumbo jet crossed the runway's rollout end onto the 1,000-ft overrun, then rolled into the dirt at about 80 to 90 KIAS. The gear quickly settled into the soil, sheared all main gear struts from the fuselage and collapsed the nose gear strut and support structure rearward into the fuselage. There was no fire and passengers and crew evacuated the aircraft.

The engine fire was caused by a cracked turbine case which activated overheat sensors in the cowling. The reason for the autospoilers failing to deploy has not been determined.

EXAMPLE 3:

MAC C-141 Rejected Takeoff Runway Excursion
Norfolk NAS, Virginia

A few years ago, a C-141 ran off the departure end of the runway during a rejected takeoff. The copilot was flying at the time when, almost simultaneously, the aircraft commander called "go" as the engineer caught a flicker on an engine oil low level light and called "reject." The crew initiated reject procedures; unfortunately, they failed to deploy spoilers as required. This factor, coupled with initiating reject beyond "go" speed, put them beyond the runway's end. No one was injured, but the aircraft sustained damage.

High speed rejected takeoffs are procedures conducted in response to an emergency. In these three examples, it would appear the cure is worse than the disease! All told, these rejects are more similar to crash landings. The key phrases here are "at or above refusal speed" and "nature of the emergency."

Those of you who believe there's always a pad built into performance factors, and Refusal Speed (V_{REF}) plus or minus 5 knots is "probably" okay, are *wrong*. In fact, there is an adjustment built into V_{REF}, but it's not for *your* use. While developing it, test pilots made a conscious effort to not move quickly between notification of a need to reject, and actually performing the procedure. This minor pause compensates for the fact that the test pilot knows the reject is going to happen and aircrews don't.

The time allotted (which varies among Dash Ones) allows aircrews to consciously determine need and physically react. In effect, if refusal speed was 100 KIAS, the airplane could be stopped were reject procedures initiated at a slightly higher airspeed, but could you decide to, and physically move, controls before the craft accelerated past that speed? The answer is an unqualified no. In the DC-10 example, the airliner actually accelerated 12 more knots despite the fact reject procedures were readily accomplished and acceleration forces went quickly from positive to negative. If you're looking for a pad, don't add it to the computed speed! In the case of V_{REF}, it doesn't exist.

Granted, had the brakes not failed, the plane probably would've stopped on the concrete. In Dehli, had the spoilers deployed, the damage may have been limited. And finally, in the C-141 example, had the spoilers been deployed, this aircraft too may have stopped. But what are we doing here? We're *"what if-ing."* Well, if we're going to do that, let's at least "what if" in a positive direction. Let's say posted refusal speed guarantees a tip-top airplane with a fast-thinking aircrew will stop prior to runway excursion, *IF* nothing else goes wrong!

That's the point of this article, let's take a real hard and thorough look at the rejected takeoff decision.

Takeoff Planning

As a quick review, basic conditions influencing takeoff performance are:

1. Gross weight.
2. Engine thrust.
3. Temperature.
4. Pressure altitude.
5. Wind direction and speed.
6. Runway slope.
7. Runway surface.

These conditions assume the takeoff is made in a normal configuration, using pilot technique as described in the appropriate operator's manual. Takeoff distance for a given gross weight is affected by engine thrust and air density. Engine thrust depends on air temperature, pressure altitude, and operation of systems requiring bleed air.

Determining Decision Points

Methodology in this article is quite simple in theory, but very complex in content. What we'll do is compare various decision point definitions. We'll use Charles E. Dole's Flight Theory and Aerodynamics textbook, Federal Aviation Regulations (FAR) Part 25, and the One-Dash-Ones for the C-5, C-141, and C-130. Terms varied among sources, so we'll select and use a single term to improve readability. Where possible, we'll choose terms most familiar to Air Force aviators. The following will be used throughout the text:

CFL:	Critical Field Length; *or* Accelerate - Stop Distance (FAR).
$V_{B(MAX)}$:	Maximum Braking Speed *or* V_{MBE}: Maximum Brake Energy Speed (FAR).
V_{MCG}:	Minimum Ground Control Speed.
V_{MCA}:	Air Minimum Control Speed.
V_{CEF}:	Critical Engine Failure Speed.
V_{REF}:	Refusal Speed; *or* V_R (1-1).
V_{GO}:	Go Speed; (C-5 and C-141 only); *or* V_1(FAR).
V_{ROT}:	Rotation Speed.

The first computation required is thrust available. This mathematically arrived-at figure is usually referred to as Takeoff Factor. From this numeric representation of acceleration capability, other factors affecting the takeoff problem are computed. Here we go:

Critical Field Length (CFL): This distance is based on temperature and pressure altitude adjusted for gross weight, stopping devices configuration, and runway condition reading. The final figure represents total length of runway required to accelerate with all engines to critical engine failure speed, experience an engine failure, and then continue to take off or stop. For a safe takeoff, the CFL must be no greater than runway available.

Individual performance manuals and FARs apply a slight twist to this definition. For example, FAR Part 25 even refers to CFL by a different name:

Accelerate - Stop Distance (FAR Part 25): The distance required for the aircraft to accelerate from brake release to V_1 with all engines operating, lose an engine, and stop, using full anti-skid braking and spoilers, but no reverse thrust. Part 25 requires the length of the weight-bearing surface (runway plus stopway) be at least equal to accelerate-stop distance.

At this point, it's interesting to note the differences between runway *required*, and runway *available*. The FARs, and C-5 and C-141 performance manuals, forbid operation when required runway exceeds available runway (what is referred to as an unbalanced runway). C-130 crews get another option—the Max Effort Takeoff.

Takeoff Ground Run: The distance through which the airplane must be accelerated, without loss of an engine, to reach takeoff speed.

Another interesting definition follows, and it's quite precise in its requirements:

All Engine Takeoff Distance (FAR Part 25): 115% of the distance required from brake release to the point where the aircraft attains a height of 35 feet. (Part 25 requires the total length of runway and clearway to be equal to takeoff distance.)

I hope one of the figures struck a note of familiarity. We Air Force aviators see it in AFM 51-37, Chapter 7; it goes like this, "When developing SIDs at civil airports in the United States, civil authorities assume that the aircraft will cross the departure end of the runway at least 35 ft above ground level. Therefore, Air Force pilots flying civil SIDs must plan to cross the departure end of the runway at least 35 ft above ground level. . ." Now you know why.

We're narrowing down performance planning to the point where we're going to determine a decision speed. Basically, we need to know some "outer edges."

From this point forward, we'll define speeds. It's essential to recognize the two types used to identify the magical "decision" speed. I'll call one type *computed*, and the other *directed*. A computed speed comes from a chart. Those are V_{ROT} (except C-130s), V_{CEF}, V_{REF}, V_{MCG}, and V_{MCA}. The directed speeds are V_{ROT} (C-130), V_{GO}, and a textbook definition of V_1. In other words, the final, agreed upon, real decision speed is in reality—*directed*. You are directed, through either a series of rules or a matrix, which speed is most critical for a given set of parameters (ie. PA, temp, RCR, thrust, etc.). This speed becomes *the* decision speed. At that point, your commitment to either go, or no-go, is the key to either surviving the rejected takeoff, or pushing "down" the weeds.

First, we need to know how fast we can get, and still be able to stop the airplane. For Herc drivers, you'll see a lot more emphasis on brake capability in this analysis. Think of it this way—in a jet, the brakes are the *primary* airplane stoppers. Thrust reversers are most effective at higher speeds, less so as the aircraft slows. Even when you consider spoilers, their purpose is to increase brake effectiveness. Point is, a Herc's reverse propeller capability is significant when it comes to stopping. So here's a term you may not be too familiar with, yet the jet jocks know it well.

$V_{B(MAX)}$ - The highest speed from which the aircraft may be brought to a stop without exceeding the maximum design absorption capability of the brakes.

This definition is identical in both the C-5 and C-141 Performance Manuals; the C-130 manual doesn't provide this figure. Galaxy crews get additional guidance on this subject: $V_{B(MAX)}$ is based on a limit stop of 33.1 million foot pounds of energy per brake. Additionally, C-5s have a *Warning* that says exceeding the maximum energy absorption capability of the brakes could result in inability to stop the airplane on the runway available. (I'd think that would be obvious.)

The FARs are a little more to the point, yet note the inverse:

V_{MBE} - Maximum Brake Energy Speed (FAR PART 25): The speed at which the brakes will not have sufficient capability to stop the aircraft.

Granted, a minor point, but still interesting that the Air Force defines it as the highest speed you can get to, and still stop. FARs define it as the speed where you'll no longer be able to stop. I guess the *real* difference must be about a knot.

The next group of definitions have to do with controlling the airplane. We've already determined at what speed we can no longer rely on the brakes, now we must find the speed needed to control the airplane, after losing an engine, both on the ground and in the air.

V_{MCG} - Minimum Ground Control Speed: The minimum speed at which the aircraft, while on the ground, can lose an outboard engine and maintain directional control.

FAR Part 25: The minimum speed at which directional control can be maintained on the runway, following an abrupt failure of the most critical engine. Nosewheel steering is not used in determining V_{MCG}; rudder steering is the determining factor.

C-141: On dry runways, full rudder deflection and positive nosewheel steering are required.

C-5: Designated minimum speed provides directional control without exceeding a lateral deviation on the runway of 25 feet.

C-130: It's a bit more conditional. They are: Number 1 engine windmilling on NTS; maximum rudder deflection limited by 180 pounds of rudder pedal force, or maximum rudder control surface deflection, whichever occurs first; maximum runway centerline deviation of 25 feet. Further, the C-130 adds a Warning to the effect that rudder boost pressure of 3,000 psi is assumed.

The corollary to ability to control the aircraft on the runway is ability to control the aircraft in the air. Again, a factor to consider when making a decision whether or not to continue takeoff.

V_{MCA} - Air Minimum Control Speed: For a generic definition, it is the minimum airspeed where the rudder can produce the necessary yawing moment to maintain heading, if an engine malfunctions. The usual requirement is V_{MCA} not be greater than 1.2 times stall speed. FAR Part 25 and One-Dash-Ones have each added a not-more-than-5 degree bank into the operating engines qualifier to their definitions.

FAR Part 25: The minimum flight speed at which directional control can be maintained using maximum rudder and no more than 5 degrees of bank into the operating engine(s).

C-5: The minimum speed at which directional control can be maintained using full rudder deflection and not more than 5 degrees of bank away from the inoperative engine with either one or two engines inoperative.

C-141: The minimum speed at which an engine can be lost and directional control maintained using full rudder deflection and not more than 5 degrees of bank.

C-130: The C-130 enjoys two, very clearly defined types of V_{MCA} speeds—One Engine and Two Engines Inoperative. Jets also have both types of air min control speeds, but their variations are with gross weight and flap settings.

One Engine V_{MCA}: The minimum speed for directional or lateral control with maximum permissible power on all operating engines, inoperative engine propeller windmilling on NTS, full rudder deflection or 180 pounds pedal force, 5 degrees of bank away from the failed engine, gear down, and flaps at 50 percent.

Two Engine V_{MCA}: (Same wing) The minimum speed for directional control with maximum permissible power on both operating engines, inoperative inboard engine feathered, and the inoperative outboard engine propeller windmilling on NTS, full rudder deflection, 5 degrees of bank away from the failed engines, gear down, and flaps at 50 percent. (Without doubt, worst case.)

Here we have two speeds with very similar meanings. However, the differences are as important as it was when we differentiated between required and available runway.

V_{CEF} Critical Engine Failure Speed: The speed to which the airplane can be accelerated, lose an engine, and then either continue the takeoff with the remaining engines or stop, in the same total runway distance.

V_{REF} Refusal Speed: (Each source agreed on the basic definition for this one.) The maximum speed the aircraft can obtain under normal acceleration and then stop in the *available remaining runway.*

C-5: The maximum speed the aircraft can attain under normal acceleration, lose an engine, be recognized, and then stop in the available remaining runway. Since V_{REF} will always provide adequate runway to either continue the takeoff or stop, it will be used in lieu of V_{CEF} for performance calculations.

C-141: The maximum speed the aircraft can attain under normal acceleration and then stop in the available runway. When Critical Field Length equals Runway Available, Critical Engine Failure Speed equals Refusal Speed.

C-130: Refusal Speed is based on runway available and is

the maximum speed the aircraft can accelerate to with engines operating at takeoff power and then stop in the available runway with two symmetrical engines in reverse, one in ground idle, one propeller windmilling, and maximum anti-skid braking. If V_{REF} is equal to or greater than Takeoff speed, use Takeoff speed as a V_{REF}.

Now, we get into some terminology you're probably familiar with, but may not really understand how it's used. In this section, we also get into what was referred to earlier as directed speeds. The first V_1 definition comes from the textbook:

V_1: The minimum indicated airspeed at which an engine failure can be experienced and the takeoff safely continued. Safe abort capability is assured if the takeoff is aborted prior to reaching V_1. V_1 is either V_{CEF} or V_{MCG}, whichever is higher. *HOWEVER*, it must never exceed V_{REF}, $V_{B(MAX)}$, or V_{GO} where appropriate.

In this definition, "where appropriate" is important. For example, it's only partially correct for C-130s, and doesn't apply at all to single engine aircraft.

The textbook definition is clearly directive in that it appoints *which* computed speed will be used. The FARs go into even further detail:

V_1—Takeoff Decision Speed (FAR Part 25): Also called critical engine failure speed, V_1 is the speed that determines a go or no-go decision in the event of an engine failure. If V_1 is set correctly, a pilot should be able to recognize an engine failure occuring just below V_1 and bring the aircraft to a stop on the remaining runway. Conversely, the pilot should be able to continue the takeoff after engine failure recognition at V_1 and climb to 35 ft before reaching the end of the runway or clearway.

Both the C-5 and C-141 provide a clear, directed speed, most appropriately called "GO" speed.

V_{GO} - GO Speed (C-5): The speed at which the pilot normally becomes committed to takeoff. If a system emergency occurs before GO speed, the takeoff shall be aborted. GO speed will be the lowest of V_{ROT}, V_{REF}, or $V_{B(MAX)}$. This speed must satisfy the following conditions:
1. If $V_{GO} = V_{REF}$, then V_{REF} must be equal to or greater than V_{MCG}.
2. If $V_{GO} = V_{B(MAX)}$, then VB(MAX), must be equal to or greater than V_{MCG} and V_{CEF}.
3. If $V_{GO} = V_{ROT}$, an increase in V_{ROT} due to wind gusts will increase GO speed an equal amount not to exceed V_{REF} or $V_{B(MAX)}$.

V_{GO} - GO Speed (C-141): The speed at which the pilot becomes committed to continue takeoff. GO speed will be the lowest of V_{REF}, $V_{B(MAX)}$, or 147 KCAS (Maximum Ground Spoiler Speed). This speed must satisfy the following conditions:

1. If $V_{GO} = V_{REF}$, $V_{B(MAX)}$, or 147 KCAS, it must be equal to or greater than V_{MCG}.
2. If $V_{GO} = V_{ROT}$, then V_{MCG} is not a factor.
3. If $V_{GO} = V_{ROT}$, an increase in VROT due to wind gusts will increase GO speed an equal amount not to exceed V_{REF} or $V_{B(MAX)}$, or 147 KCAS.

NOTE: C-130s can compute, but do not use an equivalent to a V_{GO}. For a go, no-go decision speed, V_{REF} is used. The Herc's takeoff speed provides an adequate margin above stall speed to guarantee comfortable flight characteristics and tolerance for gusts and maneuvering.

Once a firm "GO" speed is identified, a speed to rotate the aircraft must also be selected to guarantee your chances of becoming airborne after GO speed. However, lest we become too hasty in performing our rotation maneuver, we must remember that a reject remains a possibility after rotation is begun and prior to attaining GO speed.

V_{ROT} - Rotation Speed: Again, there was agreement on the basic definition: the speed at which rotation from a three point attitude to the takeoff attitude is initiated. Variations follow:

C-5: Based on a rotation to lift-off time from 3 to 5 seconds. The charted V_{ROT} ensures lift-off speed equal to or greater than V_{MCA}.

C-141: Based on a rotation takeoff attitude in 2.5 seconds. The charted V_{ROT} may be less than V_{MCG}, but never less than V_{MCA}.

FAR Part 25: Selected so that, with a normal rate of rotation, the aircraft will lift off and attain a height of 35 ft at takeoff safety speed. In no case may V_{ROT} be less than 105% of V_{MCA}.

NOTE: For normal takeoff, C-130 V_{ROT} is 5 KIAS less than takeoff speed, but never less than one engine inoperative air min control speed in ground effect. Basically, C-130 GO speed is designed around the aerodynamic factors of flight; whereas C-5 and C-141 V_{GO} is not a charted speed—it is a selection process. The C-130 GO speed is most similar to the FAR Part 25 definition where V_{REF} becomes the primary decision speed.

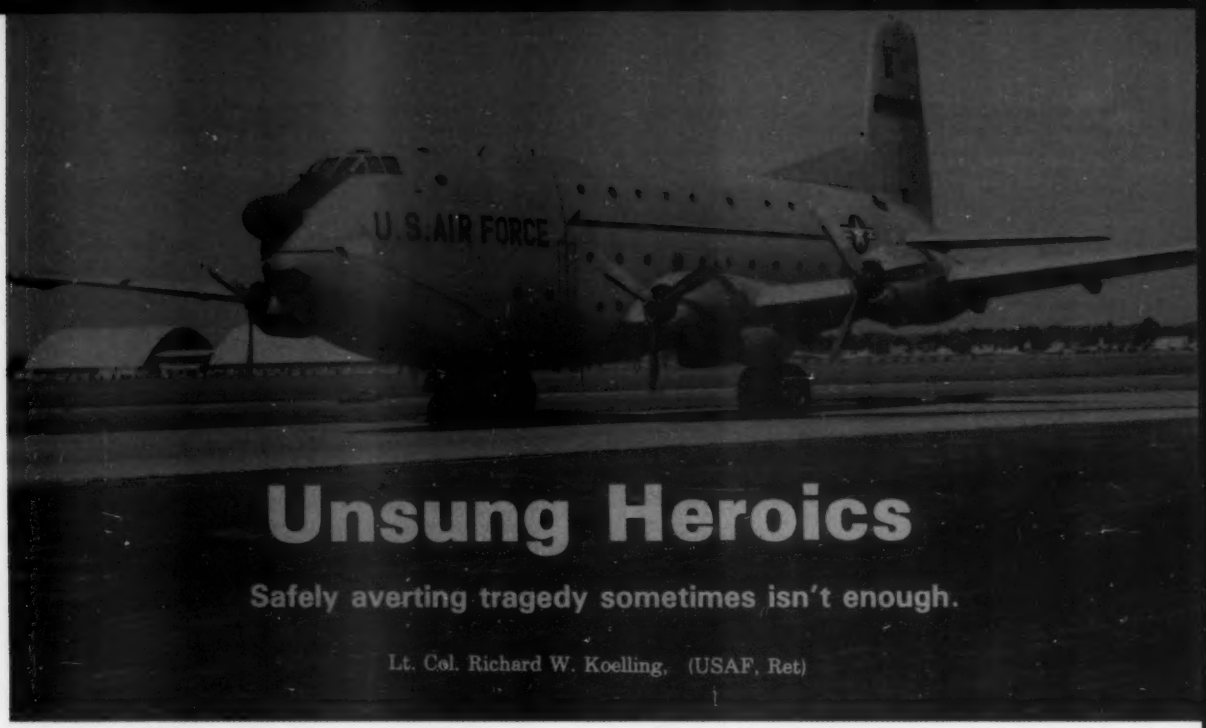
Notice that I haven't addressed any of the reasons to reject. Instead, I hope I have convinced you that on one side of decision speed, you can stop the airplane on the runway; on the other side of that speed, you should be able to fly. Whether *you* choose to pull your airplane into the air is why you're getting aircraft commander pay. I can clearly envision circumstances where I'd much rather run off the end of a runway in a "controlled" crash than take off destined to crash and burn.

What you have to accept, however, is that above decision speed—you *will* run off the runway. Accept this fact prior to making your decision to reject, and think of the following:

- As an aircraft commander, develop a "prethought-out" plan to determine under what circumstances you will reject or continue.

- During your takeoff briefing, discuss the likely decision in a reject situation.

- All crewmembers must have a clear understanding of the meaning of "GO."



Unsung Heroics

Safely averting tragedy sometimes isn't enough.

Lt. Col. Richard W. Koelling, (USAF, Ret)

(Editor's Comments: MAC's Excellence in Airmanship Award recognizes feats of airmanship which prevented or substantially reduced loss of life, personal injuries, or damage to an aircraft. Crewmembers must have averted a serious mishap by contending with a critical emergency. Normally, these heroics are expeditiously recognized, but, as in any system, some things inevitably "fall through the crack."

This story is one of them. It crossed our desk some 21 years after it occurred, but the message is still current. So, to Lt. Col. Dick Koelling and his unsung heroes, here's your story.)

On September 29, 1967, my crew and I departed Rhein-Main AB in our C-124 Globemaster. We arrived at Sembach AB 26 minutes later, onloaded Army rolling stock and five or six driver/operator passengers.

The mission was part of a NATO exercise, and our destination was Eskisehir AB, Turkey. We launched, with our load, a little more than 2 hours after landing, and proceeded to Cigli AB, Turkey (pronounced "chili") for crew rest.

The next day, we launched about 7 p.m. with command post assurance that we had prior permission approval for our destination. However, when we arrived overhead, we were denied permission to land. Command post directed us to return to Cigli, which we obediently did and logged our hour or so of flying for that day.

The next morning, we launched again; and again were denied permission to land! This time, command post directed us to hold while they tried to straighten this foolishness out. *THREE* hours later, we were told to contact tower for landing. So we did and, surprisingly enough, received clearance to land.

I called for flaps and began descent, but when the flaps reached about 10 degrees, they stopped. The engineer reported loss of hydraulic pressure and the loadmaster simultaneously reported hearing a muffled explosion from "P" compartment.

I leveled off and sent the second engineer down to "P" compartment. He reported "everything is saturated with hydraulic fluid and there's about an inch of fluid on the floor." He felt that with the high temperature of the compartment, proximity of so much electrical wiring, and hydrauliuc fluid's low flashpoint, we had a serious danger of fire.

The first engineer and I certainly agreed and decided to shut down our electrical system. Before shutting off the battery, we made a short call on VHF to an Army aircraft in the vicinity and asked him to relay our emergency situation and our intentions to Cigli Tower.

Even with power off, the scanner was still concerned with the serious fire potential in "P" compartment. So he and the loadmaster removed several CO_2 fire extinguishers from the Army vehicles and discharged them within the compartment, at short intervals, to lower the temperature. To this day, I firmly believe their

analysis and use of the CO_2 bottles may have prevented a fire and subsequent loss of aircraft, passengers, and crew.

We elected to return to Cigli AB because of superior facilities and better weather; remember, we were without electrics. The trip was uneventful and gave the crew the chance to review procedures we would use for approach and landing. Two or three times, we applied battery power to check fuel quantity and reset prop angles. The loadmaster briefed the passengers on crash and evacuation procedures. Everything appeared under control.

Landing was made into a slight crosswind, but touchdown was normal. I elected to use the airbrakes early, before I lost rudder effectiveness, and we stopped on centerline, midfield. As I shut down the engines, the scanner hollered out "we've got a fire in the left wheel-well!" I activated the alarm bell and the crew evacuated without incident.

The loadmaster helped the passengers out the left troop door and down the escape rope. One, however, had panicked and had to be forcibly carried down the rope. No small act of heroism, as the passenger was 6 ft. 4 in., and the loadmaster only 5 ft. 9 inches. Then, the loadmaster climbed back up the rope to confirm the rest of "his" crew was out of peril.

Meanwhile, fire fighters had cooled the "hot box" on the left side. My over-zealous use of airbrakes had apparently caused the overheat, but no serious damage was done. Had we been at a "normal" Air Force base, our job would've been over except for the paperwork—such was not to be the case!

There was no tow capability for anything larger than a C-47 at this one-runway base; and since we were midfield, a tug and bar couldn't be flown in either. To compound the situation, it was Sunday and all maintenance shops were closed, and those on duty doubted they would be able to fix our problem anyway. By the way, we had already narrowed the culprit to be a blown O-ring seal in the selective relief valve.

To top it off, there were several Turkish commercial aircraft and a Turkish Air Force mission with several VIPs on board due later that day. The USAFE base commander (the biggest, meanest, full colonel this young captain had ever seen) was more than insistent that *I* find a way to get the Globemaster off the runway.

I quickly got on the phone to command post to beg for help, while I simultaneously tried to assure the Cigli people I'd get the plane moved—somehow. Meanwhile, my engineers were digging through parts bins in all the shops trying to find a way to fix the O-ring. All command post could do was promise an en route support team within 24 hours. That plan alone served only to further infuriate my huge antagonist and caused him to make threats to my person!

So, when the engineers said they might have a fix, I jumped at the idea. They managed to replace the seal and, with fire trucks at the ready, we cranked up and tested the system. No leaks, but *NO* pressure either! Apparently, the engine-driven pumps had all lost their prime. By this time, the colonel was livid to the point of apoplexy and I was seriously afraid to leave the aircraft and face him. So I made a decision.

I ordered everyone off the aircraft except the engineer, put the scanner on the ground cord, and slowly taxied the aircraft down the runway. Using differential power, reverse, and whatever airbrakes remained, I turned into the taxiway. So far, so good, here we go—up the approximately 10-degree slope, then left onto the ramp.

When I shut down and got out of the plane, I was appalled to, once again, come face to face with the colonel. This time, he brought help and I must admit I was really starting to feel "put upon." He and the chief of maintenance were demanding that I move my aircraft closer to the edge of the ramp.

I calmly told them "I left the keys in the ignition, you can do whatever you want with it."

Epilogue:

We got a 48-hour ETIC from the en route support team after they got there. Command post directed us to Athens, and then we deadheaded back to Rhein-Main. I filed a complete report and, quite honestly, expected to hear a lot more. Yet, not a peep was ever again uttered.

Situations such as these often come out to a draw, particularly when they involve sensitive international questions, and I guess this was one of them. The most unfortunate loose end left untied here was Airman First Class Harrell Washington, the loadmaster who performed a courageous and potentially live-saving action—he earned, and deserved more.

(Editor's Comment: Airman Washington, Colonel Koelling, and the rest of this heroic crew, wherever you are 21 years later, we at *TMF* salute you and applaud your professionalism!)

Lt. Col. Koelling would like to hear from any of the crew from this mission. His current address is: 1942 Forest Lane, Vacaville, Calif. 95687-6115.

Flying-Hour Milestones

15,000

707 MAS
MSgt. Warren A. Thompson

10,000

41 TAS
MSgt. Marvin L. Lawson

166 TAG
Maj. George J. Gregor

335 MAS
MSgt. William F. McBride

7,500

4 MAS
Lt. Col. Laurie R. Johnson
Maj. Gregory A. Leppert
SMSgt. Joseph H. Obrien
MSgt. Stephen R. Gildea
MSgt. Gary R. Martin

20 MAS
Col. James M. Galyen

21 AFCM
Sgt. David J. Tellers

41 MAS
CMSgt. Dale F. Cozart

55 AAS
Lt. Col. Charles Botula, III.

118 TAW
Col. Jack Newcomb

166 TAGS
MSgt. Chester W. Field
MSgt. Raymond L. Holder, III.

335 MAS
MSgt. Arthur F. Lawshe
MSgt. George W. Liston, Jr.

5,000

2 AES
MSgt. Thomas B. Reece

3 MAS
Maj. Thomas R. Battista
Maj. Jordan B. Moen
TSgt. William G. Nunn

4 MAS
Lt. Col. John P. Naughton
Maj. William A. Burt
SMSgt. Rolland R. Waddell
MSgt. Brian A. McColly
TSgt. George L. McDougal
TSgt. Peter K. Turley
SSgt. Eric L. Clever
SSgt. John L. Manning

9 MAS
Lt. Col. Garold L. Garber

20 MAS
Capt. Jimmy D. Adams

30 MAS
TSgt. David J. Brown

41 MAS
Maj. Lewis W. Briggs

55 AAS
MSgt. James W. Childs, Jr.

57 MAS
Maj. Thomas L. Tasker
MSgt. James L. Bund

60 OMS
TSgt. Barry R. Cutliff

86 MAS
MSgt. Robert L. Adams
SSgt. Erick K. Kekoa

166 TAG
Lt. Col. Bruno J. Muzzi
Lt. Col. James M. Cobern
Maj. Albert C. Altevogt, Jr.

176 TAG
Maj. Glenn R. Smith

907 TAG
MSgt. James I. Williams

335 MAS
MSgt. Jerry E. Slater

707 MAS
MSgt. James C. McCants

2,500

10 MAS
Lt. Col. Fred L. May, III.

16 TATS
Maj. James R. Cox, Jr.
Maj. Charles F. Riordan, III.
Capt. Mark J. Donahue
Capt. James H. Best
Capt. William R. Blanchard
Capt. Brent F. Wells
Capt. Kevin A. Rank
TSgt. Rene J. Jensen
TSgt. Kevin J. Haney
TSgt. Peter J. Pitman
TSgt. David A. White
TSgt. George Negual
TSgt. Malcolm L. Buchanan
SSgt. Toby L. Willis
SSgt. Jarvis V. Vanderpool
SSgt. John S. Schroeder
SSgt. Webb H. Layton, III.
SSgt. Randy J. Ellis
SSgt. Timothy W. Dilley
SSgt. Gary W. Hall
SSgt. James H. Spillman
SSgt. Richard. Witthuhn

4 MAS
Lt. Col. Russell C. Calhoun
Lt. Col. Larry W. Hays
Lt. Col. Charles G. Keethler
Lt. Col. Charles A. Royce
Maj. Tony P. Exner
Maj. Lary J. Harris
Maj. Eugene W. Hiley, Jr.
Maj. Ronald D. Prynne
Maj. Wayne L. Ridenour
Maj. Bruce F. Whitcomb
Capt. Sean P. Bishop
Capt. Benjamin A. Swinford
CMSgt. Frederick M. Hilgart
SMSgt. Sylvester H. Lindemann, Jr.
MSgt. Barry A. Chadwick
MSgt. Thomas D. Languell
MSgt. Richard A. Putnam
MSgt. John T. Scott
TSgt. Thomas J. Allen
TSgt. James W. Fenton
TSgt. Rose M. Hammock
TSgt. William K. Lawrence
TSgt. Jose M. Perez
TSgt. Ricky J. Smith

TSgt. Brian W. Summ
TSgt. Jerry G. Tecca
TSgt. Edward L. Ungermann, Jr.
SSgt. Michael L. Amstutz
SSgt. Rick A. Babic
SSgt. David L. Best
SSgt. Charles M. Brittain
SSgt. Patrick C. Dunn
SSgt. Vincent J. Fernandez
SSgt. Robert J. Heinen
SSgt. Robert P. Johnson
SSgt. Michael D. Miller
SSgt. Don C. Ratliff
SSgt. Curtis E. Rickard
SSgt. William E. Sherburne
SSgt. John A. Vaughan
SSgt. David R. Young
Sgt. Stephen J. Tkach, II.

57 MAS
Capt. David J. Kratzer
TSgt. Robert B. Barber

13 MAS
Lt. Col. David C. McClure/CC

21 TAS
Lt. Col. Roger D. Baskett

56 MAS
Lt. Col. Tilford W. Harp
Maj. Louis J. Pohle
MSgt. Richard J. Baker
TSgt. Ronald A. Leonard

57 MAS
Maj. Kevin P. Flatt
Capt. David M. Burke
Capt. Charles A. McNeil
Capt. Keith R. Turner
MSgt. Raymond R. Dunlap

60 OMS
SSgt. Richard D. Giddens

62 TAS
Lt. Col. Bari L. Matherine
Lt. Col. Gary L. Williamson
Lt. Col. James J. Doyle, Jr.
Lt. Col. Michael J. Mueller
Lt. Col. Terry R. Talbot
Maj. Bruce A. Brown
Maj. John J. Cortese
Maj. Eddie J. Courtney, Jr.
Maj. Leighton B. Ewell, Jr.
Maj. Michael Fricano
Maj. Daniel R. Harkenreader
Maj. Robert L. Honaker
Maj. Frank D. Kistler
Maj. David W. May
Maj. Hurbert N. Mayhew, Jr.
Maj. Todd D. Peckman
Maj. Henri J. Pousardien
Maj. Harlan W. Ray
Maj. Paul W. Schoell
Maj. Steven W. Sickels
Maj. Larry K. Walton
Capt. Larry E. Allen
Capt. Mark A. Brenton
Capt. Robert W. Brown, Jr.
Capt. Russell P. Elliott, Jr.
Capt. Michael S. Ennis
Capt. Mark H. Fritzche
Capt. Bobby D. Hayes
Capt. Kenneth F. Hollenbeck
Capt. Charles A. Horan, III.
Capt. Robert W. Ingalls
Capt. David J. Ketnick
Capt. Kevin J. Knutson
Capt. Thomas A. Lane
Capt. Gary V. Lambert
Capt. Marcus R. Lind
Capt. Billy W. Montgomery
Capt. Mark C. Pistole
Capt. Robert D. Proffit
Capt. Mark A. Remick
Capt. Glenn E. Renfro, Jr.
Capt. David B. Roberts
Capt. Jeffrey A. Rodseth
Capt. Thomas J. Simpson
Capt. Mel Vasquez, Jr.
Capt. Kim A. Weber
Capt. Wynn H. Wiegand
Capt. Clifford A. Zapf

86 MAS
Lt. Col. Charles I. Dimmick
Lt. Col. Thomas A. Dreier
Lt. Col. William I. Griffin
Lt. Col. Robert I. Lawrence
Lt. Col. John C. Marcotte, Jr.
Lt. Col. Thomas C. Martin
Lt. Col. William H. Richard
Lt. Col. Phillip W. Spiker
Maj. Carl F. Barchfeld
Maj. Edward A. Gore
Maj. Harry W. Gore, Jr.
Maj. George C. Harper
Maj. Michael J. Maffei
Maj. George E. Meggers
Maj. Kenneth S. Smith
Capt. Alexander J. Colton
Capt. Carl D. Evans
Capt. Robert L. Hargrave
Capt. Ronald P. Jones
Capt. Kevin A. McGregor
Capt. Quinn H. Nixon
Capt. William Trinquero
CMSgt. Edward H. Pugh
SMSgt. Peter H. Leeds
SMSgt. Earl W. Vaughn
MSgt. Chester L. Amyx, Jr.
MSgt. David E. Blitch
MSgt. Michael D. Freitag
MSgt. James H. Glaspey
MSgt. Keith D. Johnson
MSgt. Tom K. Louie
MSgt. Russell F. Massey
MSgt. Joseph A. Mras
MSgt. Nathaniel Nez, Jr.
MSgt. Michael D. Riley
TSgt. Douglas D. Bateman
TSgt. Michael R. Beatty
TSgt. Clark C. Cameron
TSgt. Danny R. Conroy
TSgt. Jeffrey H. Hard
TSgt. David E. Hedrick
TSgt. Antonio S. King
TSgt. Frederick D. Lewis
TSgt. Russell P. Markestad
TSgt. Rodney F. Mayfield
TSgt. Timothy J. Nicholes
TSgt. John E. Olson
TSgt. Katherine M. Perry
TSgt. Michael L. Pierce
TSgt. George C. Ray
TSgt. Marcos Rodriquez
TSgt. Craig R. Sand
TSgt. Robert S. Thompson
SSgt. Richard V. Arvin
SSgt. Jerome Bell
SSgt. Walter D. Bigley
SSgt. Keith A. Bistromowitz
SSgt. Arthur L. Bunger
SSgt. Ronald L. Case
SSgt. Jay A. Falkner
SSgt. Douglas A. Ferguson
SSgt. Bruce T. Flynn
SSgt. Michael C. Graziano
SSgt. Kim R. Hatfield
SSgt. Samuel A. Libed
SSgt. Adrian W. Nagy
SSgt. John H. Ogden
SSgt. Scott A. Richter
SSgt. Steven L. Wicklund
Sgt. David D. Harper
Sgt. Michael O. Jones
Sgt. Klint L. Ramsey

166 TAG
Maj. Scott G. Allen
Capt. Jonathan H. GroffS
Sgt. Randy L. Hall

176 TAG
Col. Jerry P. Jones
Lt. Col. George J. Elledge
Lt. Col. Robert C. Gastrock
Lt. Col. Steven L. Gilbertson
Lt. Col. Roger J. Herrnstein
Lt. Col. Danny P. Nice
Lt. Col. Van P. Williams, Jr.
Maj. James E. Blees
Maj. George W. Bowder
Maj. John V. Bozarth
Maj. Lance G. Carey
Maj. Henry J. Dahlquist
Maj. John D. Hanscom
Maj. David W. Hargett
Maj. Terry R. Hassett
Maj. Michael A. Kelly
Maj. Ty K. Lee
Maj. Paul G. Lotakis, Jr.
Maj. Gene E. Meinel
Maj. William J. Miller
Maj. Gerald W. Morgan
Maj. Charles V. Nealy, Jr.
Maj. Thomas E. Norris, Jr.
Maj. Allan R. Olsen
Maj. Michael C. Post
Maj. Robert A. Provoncha
Maj. Howard C. Ryherd
Maj. Jack C. Scroggs
Maj. Richard A. Shaw, Jr.
Maj. Howard D. Weaver
Maj. Kevin C. Windel
Capt. Alan J. Barber
Capt. Michael O. Buckley
Capt. Richard A. Lau
Capt. David H. Mitson
Capt. Patrick A. Peterson
Capt. James A. Robinson
Capt. William D. Wooderson
SMSgt. Edward G. Benning
SMSgt. Robert A. Paulson
SMSgt. Gary A. Satterfield
MSgt. Donald R. Childs
MSgt. Michael D. Cook
MSgt. David F. Farmer
MSgt. John K. Forbes, Jr.
MSgt. Kenneth W. Jackson
MSgt. Richard W. Nyholm
MSgt. Theodore J. Poplarchik
TSgt. Lyle D. Hartzell
TSgt. Gerald W. Hoag
TSgt. Rodney R. Pasley
SSgt. William S. Rahiser

335 MAS
MSgt. Richard L. Allen
MSgt. Thomas E. Arrieta
MSgt. Alan Dragos
MSgt. Henry D. Fylstra
MSgt. Edward M. Haran
MSgt. Larry Henderson
MSgt. William N. Martini
MSgt. Robert H. Moser
MSgt. Donald F. Turner, Jr.
MSgt. Kenneth R. Uhl
MSgt. Robert M. Witkowski
TSgt. Dagmar Boltes
SSgt. Ronald J. Lamacchia
MSgt. Robert L. Brown
MSgt. Allyn R. Eaton
MSgt. Jeffrey W. Esing
MSgt. Billy G. Kelley
MSgt. Mark D. Register
MSgt. Tommy D. Rickman
MSgt. William M. Robins
MSgt. William H. Schilling
MSgt. Gary L. Seabolt
TSgt. Marian Braslavsky
TSgt. Gary J. Bodiford
TSgt. Randy D. Carey
TSgt. David R. McGinley
TSgt. Thomas E. McGuckin
TSgt. Erik A. Rohde
TSgt. Larry R. Williams
SSgt. John H. Birmingham, Jr.
SSgt. John J. Fant
SSgt. Jeffrey O. Fritts
SSgt. Rickey C. Gehris
SSgt. Mark S. Lantz
SSgt. Richard P. McLure

[redacted]

Ranks and units are those at time of award. ✦

[redacted]

QUICKSTOPPERS

A FEW ROLLING MOMENTS

During climbout, the C-141B crew noticed a lag between yoke inputs and airplane response, so the aircraft commander decided to return to base for maintenance. ATC issued a descent from FL 170 to 10,000 ft, and gave a new heading of 150 degrees, requiring a left turn. While maintaining straight and level flight, the pilot engaged the autopilot to gain better aircraft control. With heading mode engaged, he positioned the heading marker to 150 degrees (a 30-degree heading change). The airplane abruptly rolled through 40 degrees bank and began a 1,500 FPM climb. (In this mode, bank angle should be limited to 38 degrees.) During the maneuver, the pilot noted the yoke was full left and immediately disengaged the autopilot using the "A/P disc" button. With the autopilot disconnected, there's no way to know if the autopilot would have corrected the bank angle to the limit or allowed bank to further increase. With the airplane under control once more, airplane and crew uneventfully returned to base. Maintenance found no autopilot discrepancies.

A word to the wise: It's great to "let George do it," but he bears close scrutiny, too.

A PREFLIGHT FOR ALL

During preflight inspection of a Mooney 201, the pilot heard faint chirping from the tail area which was "enlivened" when the tailcone was tapped. He removed the access panels and discovered a bird's nest, complete with two hungry chicks. There was also an inch of water which, together with bird droppings, could cause corrosion. A thorough preflight keeps things right.

GEAR? WHAT GEAR?

Our mishap pilot was receiving his initial checkout in a Cessna 172RG (Retractable Gear). Flight was uneventful through handling characteristics training (turns, stalls, etc.). Following a stall series, the crew (and airplane) proceeded to the airport for touch and goes. The pilot flew the first traffic pattern and landing, followed by the instructor demonstrating the second. The mishap pilot flew the third and fourth patterns. While on downwind for the fourth pattern, tower told him to extend downwind for traffic. Both pilots, while looking for traffic, were distracted and failed to lower the gear. Neither noticed their omission until they felt the airplane impact the runway. (Rollout was shorter than usual, and it took lots of power to taxi.)

POGO WAS RIGHT!

The MH-53J was on an overwater "live fire" training mission. After firing approximately 450 rounds, the gunner heard a muffled bang. The barrel jacket and muzzle brake separated from the gun and the helo was struck by shrapnel from several .50 caliber rounds. The left and tail gunners saw the barrel jacket fall into the water. They immediately safed and cleared all weapons, and the helo returned to base. Inspection revealed one puncture and several nicks around the left scanner's window along with loss of the barrel jacket and muzzle brake from the left .50 caliber machine gun.

DON'T BE AFRAID TO TRY . . .

The idea of sitting down, pen in hand, and trying to put your thoughts on paper is certainly scary . . . *we know* . . . The *TMF* staff goes through it every month. But once we start, words seems to come together and the feeling of satisfaction we get when done is unique. Relief, of course, (a few days' respite before the next issue) but also a sense of pride.

We thought we were the only persons experiencing those feelings, but here are a few words from one of our Honorable Mention winners who graciously allowed us to quote him. He wrote ". . . I want to thank *TMF* for sponsoring the writing contest. It gave me the kick in the pants I needed to start writing. I have discovered the enjoyment and satisfaction of creating something that is truly my own . . . The important thing is that they (the people out there) are getting the safety message, and I feel our people are flying and working with a little more safety consciousness . . ."

We couldn't have said it better. Try it, you'll like it! Follow the rules below.

THE RULES

The 1989 MAC Flight Safety Writing Contest is conducted according to MACR 900-3 and these rules. Entries must be original, unpublished, *contain an aviation safety/mishap prevention message*, and be postmarked no later than 31 March 1989. Stories must be between 1,000 and 3,000 words long (approximately 6 to 14 double-spaced typed pages). Poetry should average 75 to 100 lines. Manuscripts must be typed, double-spaced, and submitted in two copies. Identify entries by title only and attach a cover sheet indicating author's name, address, duty phone, unit and home address. Please include a brief autobiography.

The contest is open to all. Entries qualifying under the above rules earn their author a complimentary one-year subscription to *TMF*. However, desk sets and plaques may be awarded only to military members and civilian employees of the Department of the Air Force and Air Reserve Components. Other entries may be selected for Honorable Mention in a special category.

Winning entries will be published in *TMF*. Submit to:

MAC Flight Safety Writing Contest
HQ MAC/IGFE
Scott AFB, Illinois 62225-5101

After Deadlines

ATC VISITS SCOTT—Air Training Command officials visited Military Airlift Command headquarters in mid-December to discuss the new specialized undergraduate pilot training program (SUPT) that will affect future MAC aircrews. The ATC entourage, headed by Brig. Gen. Walter Kross, explained how their new program will train pilots specifically for airlift, thereby giving MAC a better aircrew member. Under SUPT, students will go through a primary flying training phase followed by one of two specialized advanced tracks—a tanker-transport track or a bomber-fighter track. ATC officials expect the program to start at Reese AFB, Texas, sometime in 1992.

FIRE DAMAGES GALAXY—A fire on the upper deck of a C-5 at Travis AFB, Calif., on 30 December 1988, resulted in MAC's second FY 89 Class A flight mishap. No one was injured during the fire or subsequent evacuation.

YOU ARE WANTED—No, not by the County Mounties or Smokey, but by *The MAC Flyer* staff. That's right, if you're a moderately creative rated major and have the desire to spread MAC's safety message, give us a call. We still have at least one highly desirable associate editor position available. Don't delay, they're going fast!! Write to: Supervising Editor, HQ MAC/IGFE, Scott AFB, Illinois, 62225-5101 or call AV 576-3534/5542, commercial (618) 256-3534.

MAC SUPPORTS ARMENIAN EARTHQUAKE RELIEF—Military Airlift Command airplanes transported more than 144 tons of supplies and equipment and 45 specialists in support of the Armenian earthquake relief effort. The first of six C-141 Starlifters began airlifting supplies to Armenia on 10 December. Flights originated from Andrews AFB, Maryland; Incirlik AB, Turkey; Ramstein AB, West Germany; and McGuire AFB New Jersey. A C-5B Galaxy also supported the effort by transporting over 68 tons of supplies and equipment from Dover AFB, Delaware, to Incirlik. The cargo was then flown to Yerevan, Soviet Armenia, by C-141s. Cargo included search and rescue specialists and equipment, communications specialists and equipment, bottled water, medical supplies, cots, tents, blankets, plastic sheeting, and other items.

TOUCH'N GO

"Yeah, scanning for traffic is important, but we're IFR and there's never any around here."